

CLAIMS

1. A method for providing a fibre-containing pectin product from a plant material, said method comprising the steps of:

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(i) providing an *in situ* reaction system by swelling the plant material in an aqueous solution, where said aqueous solution comprising at least one salt,

10 (ii) subjecting pectin present in the swollen plant material from step (i) to a de-esterification treatment, and

(iii) separating the de-esterified fibre-containing pectin product.

2. The method according to claim 1, wherein the aqueous solution does not contain an
15 organic solvent.

3. The method according to any one of claims 1 or 2, wherein the plant material is swelled in the aqueous solution for 1 to 120 minutes.

20 4. The method according to any one of claims 1-3, wherein the plant material is swelled in the aqueous solution at a temperature in the range of 0-120°C.

25 5. The method according to any one of claims 1-4, wherein the plant material is swelled in the aqueous solution providing a dry matter content of the plant material in a range from 1-50%.

6. The method according to any one of claims 1-5, wherein the amount of the at least one salt correspond to a salt concentration from 1 mmol to 30 mmol per gram of plant material dry matter, such as from 5 mmol to 15 mmol.

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7. The method according to any one of claims 1-6, wherein the aqueous solution is an inorganic aqueous solution.

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8. The method according to any one of claims 1-7, wherein the at least one salt is a water-soluble and neutral salt.

9. The method according to claim 8, wherein the water-soluble and/or neutral salt is selected from the group consisting of sodium salts, potassium salts, calcium salts, chloride salts, nitrate salts and mixtures thereof.
- 5 10. The method according to any one of claims 1-9, wherein the de-esterification treatment is continued for 1 to 120 minutes.
11. The method according to any one of claims 1-10, wherein the de-esterification treatment is performed at a temperature in the range of 0-120°C.
- 10 12. The method according to any one of claims 1-11, wherein the de-esterification treatment is performed with a dry matter content of the plant material in a range from 1-50%.
- 15 13. The method according to any one of claims 1-12, wherein the de-esterification treatment in step (ii) is an alkaline treatment.
14. The method according to claim 13, wherein alkaline condition provided in step (ii) is provided by the addition of a alkaline reagent giving a pH above 7, such as above 8, e.g. above 9, such as above 10, e.g. above 11, such as above 12, e.g. above 13, such as 14. (in the range from 7-14, such as in the range of 8-13, e.g. in the range of 9-13, such as in the range of 10-13, e.g. in the range of 11-13, such as in the range of 11.5-12.5)
- 25 15. The method according to claim 14, wherein the alkaline reagent is at least one of ammonia or other low molecular amines, diamines or amino acids, hydroxides of sodium, potassium and calcium or hydroxides of organic bases, such as tetramethylammonium-hydroxide.
- 30 16. The method according to claim 15, wherein the amount of alkaline reagent is from 20 mmol to 80 mmol of basic reagent per gram of pectin-containing plant dry matter.
17. The method according to any one of claims 1-16, wherein the plant material is further subjected to an amidation treatment.
- 35 18. The method according to claim 17, wherein the amidation is provided by addition of an amidation reagent selected from the group consisting of ammonia or other low molecular amines, diamines or amino acids.

19. The method according to any one of claims 17 or 18, wherein the swollen plant material obtained in step (i) is treated with the amidation reagent for 1 to 120 minutes.

20. The method according to any one of claims 17-19, wherein the swollen plant material obtained in step (i) is treated with the amidation reagent at a temperature in the range of -15 to 75°C.

21. The method according to any one of claims 1-20, wherein the separated and de-esterified fibre-containing product obtained in step (iii) is subjected to at least one washing step and/or at least one pressing step to obtain the fibre-containing pectin product.

22. The method according to claim 21 wherein the washed and/or dried fibre-containing pectin product is dried to a dry matter content of at least 90% by weight, and optionally comminuted.

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23. The method according to any one of claims 1 or 22, wherein the fibre-containing pectin product has a degree of esterification from 0-80, such as from 0-50, e.g. from 2-50, such as from 2-45, e.g. from 2-40, such as from 5-50, e.g. from 10-50, such as from 10-40, e.g. from 15-35.

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24. The method according to any one of claims 1-23, wherein the fibre-containing pectin product has a degree of amidation of not more than 95% e.g. not more than 75%, such as not more than 60%, not more than 50%, such as not more than 40%, e.g. not more than 30%, such as not more than 25%, e.g. not more than 20%.

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25. The method according to any one of claims 1-24, wherein the fibre-containing pectin product obtained in step (iii) has a dry matter content of at least 1% (w/w) of the dry matter, such as at least 5% (w/w) of the dry matter, e.g. at least 10% (w/w) of the dry matter, such as at least 15% (w/w) of the dry matter, e.g. at least 25% (w/w) of the dry matter, such as at least 50% (w/w) of the dry matter, e.g. at least 75% (w/w) of the dry matter, such as at least 85% (w/w) of the dry matter, e.g. at least 95% (w/w) of the dry matter..

26. The method according to any one of claims 1-25, wherein the plant material is obtained from a native vegetable material in a fresh or dried state.

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27. The method according to any one of claims 1-26, wherein the plant material is selected from the group consisting of potato pulp, sugar beet pulp, pomace residues from apples, peels or pulp from citrus fruits, such as lemon, orange, mandarin, lime, and grapefruit.

28. A fibre-containing pectin product obtainable by a method according to any one of claims 1-27.

5 29. The product according to claim 28, wherein the fibre content present in the product is at least 1% (w/w) of the dry matter, such as at least 5% (w/w) of the dry matter, e.g. at least 10% (w/w) of the dry matter, such as at least 15% (w/w) of the dry matter, e.g. at least 25% (w/w) of the dry matter, such as at least 50% (w/w) of the dry matter, e.g. at least 75% (w/w) of the dry matter, such as at least 85% (w/w) of the dry matter, e.g. at 10 least 95% (w/w) of the dry matter.

30. A method for providing a pectin product, said method comprising the steps of:

15 (i) providing a fibre-containing pectin product according to any one of claims 28 or 29,

20 (ii) adding an extraction medium to the fibre-containing pectin product providing an extraction suspension,

25 (iii) adjusting the pH of the extraction suspension to a pH in the range of 1-12,

20 (iv) adjusting the temperature of the extraction suspension to a temperature in the range of 0-120°C, and

25 (v) isolating the pectin product from the aqueous phase of the extracting medium.

31. The method according to claim 30, wherein the extraction medium has a pH in the range of 1-6, such as in the range of 2-6, e.g. in the range of 2-5, such as in the range of 3-5, e.g. in the range of 4-5.

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32. The method according to any one of claims 30 or 31, wherein the temperature is in the range of 40-100°C, such as in the range of 60-80°C.

33. The method according to any one of claims 30-32, wherein the pectin product is 35 isolated by any known method such as precipitation, extraction, centrifugation, filtration, chromatography, drying.

34. A pectin product obtainable by a method according to any one of claims 30-33.

35. The product according to claim 34, wherein said product fulfils at least one of following requirements:

5 (i) the product has a viscosity of at least 5 cp when mixed in a concentration of at the most 1% (w/w) of pectin in a solution and measured by method A, or

(ii) the product has a viscosity which is at least 2 times higher than the viscosity of conventional manufactured pectin products when mixed in a concentration of at the most 1% (w/w) of pectin in a solution and measured by method A.

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36. A product comprising pectin that fulfils at least one of following requirements:

15 (i) the product has a viscosity of at least 5 cp when mixed in a concentration of at the most 1% (w/w) of pectin in a solution and measured by method A, or

(ii) the product has a viscosity which is at least 2 times higher than the viscosity of conventional manufactured pectin products when mixed in a concentration of at the most 1% (w/w) of pectin in a solution and measured by method A.

20 37. The product according to claim 36, wherein the product has a viscosity of at least 30 cp when mixed in a concentration of at the most 1% (w/w) of pectin in a solution, such as at least 10 cp, e.g. at least 15 cp, such as at least 20 cp, e.g. at least 25 cp, such as at least 35 cp, e.g. at least 40 cp, such as at least 45 cp, e.g. at least 50 cp, such as at least 75 cp, e.g. at least 100 cp, such as at least 150 cp, e.g. at least 200 cp.

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38. The product according to any one of claims 36 or 37 wherein the product has a viscosity which is at least 2.5 times higher than conventional used pectin products, such as at least 3 times higher, e.g. at least 3.5 times higher, such as at least 4 times higher, e.g. at least 5 times higher.

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39. The product according to any one of claims 36-38, wherein the pectin has a degree of esterification from 0-80, such as from 0-50, e.g. from 2-50, such as from 2-45, e.g. from 2-40, such as from 5-50, e.g. from 10-50 and/or a degree of amidation of not more than 95% e.g. not more than 75%, such as not more than 60%, not more than 50%, such as 35 not more than 40%, e.g. not more than 30%, such as not more than 25%, e.g. not more than 20%.

40. Use of a product according to any one of claims 28-29, 34-35 or 36-39 for the encapsulation of, e.g., easily volatile lipid and/or water-soluble aromatic and colouring agents or by encapsulating micronutrients, flavouring agents, vitamins, etc.
- 5 41. Use of a product according to any one of claims 28-29, 34-35 or 36-39 in the production of solid and liquid pharmaceutical compositions, including, e.g., tablets, suspensions, emulsions, etc. and as components in cosmetic products, such as perfumes, creams, and lotions, etc
- 10 42. Use of a product according to any one of claims 28-29, 34-35 or 36-39 as a viscosifying agent and/or an emulsifying agent
43. Use of a product according to any one of claims 28-29, 34-35 or 36-39 for fat replacement or for the replacement of tobacco.